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Subject:
Comments on *Sampling and Analysis Plan, Yosemite Creek Sediment Removal Assessment*, January 16, 2009, prepared for U.S. Environmental Protection Agency, Region IX, by Ecology and Environment, Inc.

This memorandum has been prepared by ARCADIS on behalf of the Yosemite Creek PRP Group and presents our comments on the above-referenced document, hereinafter referred to as the E&E SAP. To direct and organize our comments, we utilized several sediment management documents that present established guidance for conducting sediment investigations and remedial actions at sediment sites (DON, 2003; NRC, 2001; USEPA, 2001, 2002, 2005). For example, the *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (USEPA, 2005) identifies the following 11 key risk management principles for managing sediment sites:

- 1) Control sources early
- 2) Involve the community early and often
- 3) Coordinate with states, local governments, Indian tribes, and natural resource trustees
- 4) Develop and refine a conceptual site model that considers sediment stability
- 5) Use an iterative approach in a risk-based framework
- 6) Carefully evaluate the assumptions and uncertainties associated with site characterization data and site models

- 7) Select site-specific, project-specific, and sediment-specific risk management approaches that will achieve risk-based goals
- 8) Ensure that sediment cleanup levels are clearly tied to risk management goals
- 9) Maximize the effectiveness of institutional controls and recognize their limitations
- 10) Design remedies to minimize short-term risks while achieving long-term protection
- 11) Monitor during and after sediment remediation to assess and document remedy effectiveness.

Our experience at dozens of sediment sites in California and throughout the country confirms that by addressing these principles, the appropriate data are collected, stakeholders are involved, remedial objectives are defined, and key technical issues (e.g., sediment stability, potential for recontamination, engineering needs) are addressed. The following general comments, which follow the flow of the E&E SAP, provide a more detailed discussion of these issues.

Comment 1: Development of a Site Conceptual Model that Addresses Sources and Sediment Stability (Section 3 and Appendix A)

The development of a realistic conceptual site model (CSM) is a critical component of developing a successful sediment remediation of the Yosemite Slough (the Site or the Slough). The CSM should include identification of: (1) all ongoing sources to sediment, (2) transport pathways, (3) exposure pathways, and (4) receptors. A preliminary CSM can be used to identify data gaps and to develop data quality objectives (DQOs) for the sampling plan design. The CSM is refined as additional field data are collected and is used to define the most appropriate and effective remedies for the Site. Through the development of a CSM for Yosemite Slough, ongoing sources can be identified and controlled, increasing the effectiveness of the proposed cleanup and minimizing the potential for recontamination. Additionally, understanding sediment movement at the Site will aid in assessing the potential for recontamination and the appropriateness of monitored natural recovery as a potential remedial alternative.

To develop a CSM, certain questions must be asked. Many of these questions directly relate to one or more of the key principles identified above. For example:

- What are the potential sources? Understanding potential sources is a critical component of the CSM, and controlling these sources is the first key sediment management principle identified by EPA (2005). A number of potential sources have been identified at the Site; for example, Section 2.2 of the E&E SAP mentions that the Site receives “discharges of treated sewage and stormwater.” (Please note that it is our understanding that the Site receives stormwater and *untreated* sewage during overflows from the combined sewer outfalls [CSOs].) However, there are no existing data available, and no planned collection of additional data in the E&E SAP that

addresses ongoing input from these potential sources into the Slough. Comment 8 describes in more detail specific suggestions for data collection associated with this issue.

- What are the potential transport pathways? Understanding transport pathways for contaminants in sediment addresses both the potential for receptors to be exposed to contaminants and the potential for migration of contaminants out of the slough (i.e., offsite). These fundamental issues relate to the current and future stability of the sediments within the Site. There are no existing data available, and no planned collection of additional data in the E&E SAP that addresses sediment stability in the Site. Comment 8 describes in more detail specific suggestions for data collection associated with this issue.
- What are the exposure pathways and receptors? Understanding the potential pathways, receptors, and potential risks associated with these exposures is critical to the development of the CSM, risk management goals, and the resulting remediation. The E&E SAP focuses on sediment characterization, yet Appendix A identifies potential exposure scenarios as including direct exposure to sediment, exposure to bay water, and exposure to contaminated prey. Based on these other exposure scenarios, should additional media be sampled?

In summary, a CSM for the Site can be used to identify data gaps and to develop DQOs, which should serve as the basis for the sampling plan. This will ensure that the appropriate data are being collected and will minimize the need for additional field sampling.

Comment 2: Development of Risk Management Goals and Remedial Action Objectives (Section 3 and Appendix A)

Clearly defining the risk management goals is a critical component of a successful project, as they provide a general description of what the cleanup is expected to accomplish. Additionally, risk management goals form the framework for the DQOs. Risk management goals must take into account the CSM and include future land use, including receptors and exposure pathways, and involve all the appropriate stakeholders to ascertain that they sufficiently address concerns. Only when the risk management goals are appropriately defined can they then be used to develop the DQOs and suitable cleanup goals. Risk management goals can also be used as a basis to compare remedial alternatives regarding their levels of protectiveness, short-term risks, and long-term benefits.

According to the E&E SAP, the data to be collected will be used to: (1) evaluate potential future actions at the Site, and (2) identify and delineate areas above action levels in sediment. With regard to the first objective, it is agreed that it is important at this stage to evaluate potential future actions at the Site. However, a number of additional issues should be evaluated to address this objective, including:

- Develop risk management goals.

- Confirm “action levels” are relevant and detection limits are sufficiently sensitive. As necessary, develop additional “action levels” that may more appropriate to meeting the risk management goals.
- Define nature and extent of contamination.
- Identify sources at the Site, assess sediment stability, and evaluate potential for recontamination and monitored natural recovery.
- Collect preliminary engineering data necessary to evaluate remedial alternatives.

Potential future actions are dependent on the ways in which these issues are addressed.

Comment 3: COPC List (Section 3)

At our January 23, 2009 meeting, EPA clarified that the constituents of potential concern (COPCs) for this project are defined in the Action Memorandum (EPA, undated): lead, mercury, zinc, polychlorinated biphenyls (PCBs), dieldrin, chlordane, and dichlorodiphenyltrichloroethane (DDT). However, a broader list of COPCs is provided in the E&E SAP and consists of the COPCs in the Action Memorandum plus chromium and total petroleum hydrocarbons (TPH). Consequently, the E&E SAP should clarify the rationale for the addition of chromium and TPH to the COPC list.

COPCs are those compounds that require further evaluation (or remediation) because they pose potentially unacceptable risks to human health or the environment. The evaluation of potential risks should flow from the CSM and the development of site-specific risk management goals. Currently, the selection of COPCs is based on exceedances of action levels. The action levels used in this project should be related to the risk management goals for the Site. As discussed in Comment 4, we do not believe that the selected action levels are appropriate. We recommend that COPCs be identified by either: (1) conducting a risk assessment, or (2) developing action levels appropriate for the site-specific CSM and risk management goals for this project.

Comment 4: Action Levels (Section 3)

An assumption in the E&E SAP is that concentrations above action levels (defined in the E&E SAP as National Oceanic and Atmospheric Administration [NOAA] effects range median [ERM] values) are unacceptably elevated. The sample design was based on this assumption. However, the E&E SAP does not identify the relevant receptors for the Site based on current or future land uses. Potential exposure routes and pathways to these receptors from contaminants in sediments are also not identified.

As described on the NOAA website (NOAA, 2008), ERMs were developed by NOAA as informal, interpretive tools for the National Status and Trends (NS&T) Program. These guidelines were based on

the potential for sediment toxicity to benthic invertebrates and were not meant to be promulgated as regulatory criteria or standards. As stated by NOAA in referring to the ERM, “The guidelines were not promulgated as regulatory criteria or standards. They were not intended as cleanup or remediation targets, nor as discharge attainment targets. Nor were they intended as pass-fail criteria for dredged material disposal decisions or any other regulatory purpose. **Rather, they were intended as informal (non-regulatory) guidelines for use in interpreting chemical data from analyses of sediments.**” (Bold emphasis is from NOAA).

As described in NOAA’s guidance (NOAA, 1999), exceedances of ERM may give an indication of toxicity, which should be confirmed through the use of site-specific toxicity bioassays. Bioassays conducted at Yosemite Slough (Battelle, 2004) did not indicate widespread toxicity of sediments to benthic invertebrates. In fact, sediment toxicity at Yosemite Slough was generally similar to that at reference sites in San Francisco Bay. Therefore, exceedances of ERM at Yosemite Slough are not indicative of adverse effects to benthic invertebrates. Additionally, bioaccumulative compounds such as mercury, PCBs, and DDT are not acutely toxic, and as described in NOAA (1999), the ERM for these compounds are not reliable indicators of toxicity.

Based on the above, ERM may not be the most appropriate basis for establishing action levels for this project. Action levels should relate to the risk management objectives established for a site. We recommend that the CSM, risk management objectives, and potential human health and ecological risks be identified first, then action levels developed that relate directly to these issues.

The action level section in the E&E SAP also includes a discussion about background levels in San Francisco Bay sediments. Ambient concentrations for inorganic and organic constituents in sediment have been developed by the San Francisco Regional Water Quality Control Board (SFRWQCB, 1998). This ambient dataset is more comprehensive than the reference study conducted by Battelle (2004). Additionally, the SFRWQCB ambient dataset characterizes ambient concentrations of organic compounds in Bay sediments. We recommend that this dataset be used, and that concentrations of both inorganic and organic compounds at Yosemite Slough be compared to these values.

Comment 5: Data Quality Objectives (Appendix A)

The two principal study questions on page 5 of Appendix A focus on identifying (1) if COPC concentrations in sediments at the Site exceed action levels, and (2) what the volume of the contaminated sediment is. Appendix A identifies four actions that could result from these principal questions. In the first and second actions (see page 5, Appendix A), action levels are used to decide if a removal action is warranted. However, as noted above, we do not believe that ERM are the appropriate action levels to use. The third action (see page 5, Appendix A) focuses on planning the removal action and waste disposal. It is our opinion that insufficient data are being collected to meet this objective. For example, basic engineering data are lacking that would be required for remedial design. Finally, the fourth action

(see page 5, Appendix A) addresses the potential need for post-removal action restoration and stormwater monitoring. If post-removal action restoration and stormwater monitoring are required, baseline data should be collected now to support those activities, as well as address additional potential data gaps. For example, what is the current contribution to the Site from the periodic overflows of stormwater and untreated sewage from the CSOs? Are these overflows a potential source? None of these data needs are addressed by the E&E SAP. Comments 7 and 8 provide recommendations regarding stormwater data needs.

The proposed data that are to be collected only address nature and extent questions and do not address other data needs as described above. Additionally, how were the spatial boundaries of the project areas defined? In particular, how was the boundary at the mouth of the slough defined? It appears that the proposed Site boundaries identified by the sampling grid in Figure 3 are shifted to the east, and outside the previously described boundaries of the Site.

The decision rule used in the E&E SAP infers that removal of sediments above the action levels is protective of human health and the environment. Based on NOAA's description of ERMs as being screening guidelines for sediment toxicity, how are ERMs protective of other receptors such as humans and wildlife?

The E&E SAP should clarify how the consequence of decision errors will be evaluated because evaluations of contaminant migration, human health risk, and ecological risks under current or future Site conditions are not proposed.

Specific data quality indicators have not been defined in the E&E SAP. How will congeners and Aroclors be compared? How will total PCBs be calculated? How do the proposed 20 PCB congeners compare to the congeners sampled in other sediment investigations in San Francisco Bay. Will the data be comparable to other nearby or regional datasets? We believe these questions are important because the comparison of total PCB concentrations developed in different ways might be an "apple to oranges" comparison. For example, Battelle summed 20 congeners to develop a total PCB concentration for Yosemite Slough (Battelle 2004). At Hunters Point Shipyard, total PCBs were estimated as two times the sum of 22 congeners (Battelle et al. 2005). For the most recent Regional Monitoring Program (RMP) sampling, the San Francisco Estuary Institute (SFEI) sums the total of 40 congeners (SFEI 2007). Consequently, the total PCB values for these three studies are not calculated in the same manner, nor do they use the same PCB congeners. The E&E SAP should specify these details.

If comparisons among sites will be conducted, or historical trends evaluated, we also recommend that percent moisture, grain size, and total organic carbon be collected for each sample so that the proper conversions can be conducted.

Comment 6: Evaluation of Data (Section 3)

Once appropriate data are collected, the data should be evaluated to assess whether remediation is necessary. If the necessity of remediation is confirmed, then the data should be used to evaluate remedial alternatives, including dredging, capping, and monitored natural recovery. A recontamination evaluation should also be performed. U.S. Environmental Protection Agency (USEPA) guidance on evaluating remedial alternatives should be followed (USEPA, 1988, 2005). Once a remedial alternative is selected, which may include multiple technologies (such as dredging, capping, and monitored natural recovery), the remedial alternative can be appropriately designed and implemented to maximize the likelihood of a successful project in meeting the risk management goals.

Comment 7: Sampling and Analysis (Sections 4, 5, and 6)

As previously mentioned, we recommend that a CSM be developed, risk management goals be identified, and site-specific DQOs developed. Based on these site-specific DQOs, a sampling design can be proposed. For example, if identifying potential sources is a DQO, a sample design that uses the historical data and an understanding of potential sources to place sample locations would be appropriate. If the DQO focuses on potential exposure to receptors, characterizing sediment and other media (such as tissue) in an exposure unit would be appropriate. If characterizing a hot spot for the remedial design is the DQO, the hot spot size should be related to the remediation unit. Without this information and other details (e.g., the GIS coordinates of the proposed sampling locations), our review of the sampling design in Section 4 is incomplete and we cannot adequately comment on the appropriateness of the proposed locations. We have also included our comments specific to the proposed sample design in the following paragraphs.

The E&E SAP should provide more specificity regarding the method of sample collection. The E&E SAP proposed several methods of collecting the sediment (e.g., hand auger, Encore™); many of these methods have limited potential for success and are likely to result in refusal or difficulty with sampling equipment. Because previous sampling had significant refusal at depth, it is recognized that debris or shallow bedrock may make it difficult to collect the proposed cores. We believe that information on the depth to bedrock is critical for the engineering evaluation (see Comment 9), and suggest protocols be added to ensure that additional cores are attempted if refusal is met and to assess whether refusal is caused by debris or bedrock.

Existing information on the Site should be used to guide selection of the sampling method, including the fact that the Site regularly inundates with the tides twice daily. Based on our experience, we recommend using a vibracore sampler mounted on a boat at high tide. We believe this would be the safest and most reliable method for collecting sediment samples at this Site.

In addition to the 1-foot sampling depth intervals, collecting and analyzing surface sediments (defined as the top 5 centimeters) is required to evaluate the most significant exposure horizon for most sediment receptors, address recent sediment deposition, evaluate trends from the surface sample data previously collected at the Site, and compare to other sediment investigations in San Francisco Bay.

The purpose of the field split samples should be stated. In general, heterogeneous media such as soil or sediment, do not lend themselves to thorough homogenization. Therefore, field splits of sediment rarely act as duplicates.

Section 7 of the E&E SAP states that decontamination fluids will be allowed to either drain to the Site and/or evaporate. Draining to the Site without determining the contents of the discharge is not appropriate. We recommend collecting the fluids in an appropriate container and sampling to identify the proper disposal method.

Comment 8: Sediment Stability and the Potential for Recontamination and Monitored Natural Recovery (Sections 3, 4, and 5)

Based on research funded by the National Research Council (NRC), dredging is not always an effective remedial option (NRC, 2007). The research suggests that while dredging can remove a large percentage of the contaminant mass, often residual sediment cannot effectively be removed to achieve the targeted risk reduction. The E&E SAP proposes collection of data that only evaluates the nature and extent of contamination. To evaluate other remedial alternatives besides dredging (such as monitored natural recovery) and to evaluate the potential for recontamination, additional data should be collected. These data include:

- **Source evaluation** – Deploy sediment traps in the CSOs to evaluate mass of contaminants from CSOs. Evaluate banks for stability and collect soil samples to evaluate mass of contaminants from banks. Collect soil/sludge samples from the various CSO boxes that discharge into the Site.
- **Sedimentation evaluation** – Deploy sediment traps in the slough and analyze selected cores for ^{137}Cs and ^{210}Pb to evaluate sedimentation rate in the slough. Collect and use basic engineering information discussed below (Section 9.0) including, at a minimum, topography, bathymetry, sediment thickness, and grain size distribution.

Comment 9: Engineering Issues (Section 3, 4, and 5)

The E&E SAP only addresses collection of data needed to assess sediment quality (i.e., chemistry). Technical guidelines developed by the U.S. Army Corps of Engineers (USACE) recommend that engineering data, such as Site bathymetry and sediment physical properties, be collected along with sediment quality data, as part of the overall Site characterization for dredging projects that involve

contaminated sediments (USACE, 2008). Engineering data will be needed to properly design and implement the remedy, select viable technologies, and estimated costs. Some of the engineering data can and should be collected during the proposed sampling effort to reduce the number of sampling events and to complete sampling in a timely fashion. These data needs include:

- Bathymetry – Topographic and bathymetric surveys should be performed that can be used for design and determination of water depths. This is particularly important for the cofferdam design and to generate a proper base map for development of drawings.
- Geotechnical Properties / Soil Classification:
 - Index Properties – Determine moisture content, Atterberg limits, grain size, in-situ density, and total organic content. Index properties will be used for soil classification, to determine weight-volume relationships, and to identify general material characteristics (e.g., material handling characteristics).
 - Vane Shear Testing – Use hand-operated device to measure the undrained soil/sediment shear strength of cohesive material (e.g., bay mud) at each sampling location and at various depths. Knowledge of the sediment strength will help assess equipment use within the slough.
 - Sediment Thickness – Determine by pushing or driving a steel bar or wooden stick into the sediment until a hard layer or refusal is encountered. Refusal may also be encountered during sampling. It should be confirmed whether refusal is due to hard soil layer or bedrock. Knowledge of the sediment thickness will help determine the practical sediment removal depth.
 - Bulk Samples for Bench-Scale Testing – Collect bulk samples for bench-scale testing, including treatability/solidification testing to estimate the amount of reagent (e.g., lime) needed to meet paint-filter requirements. Additional testing may be performed to determine dewatering demand/characteristics (also refer to the last bullet below, regarding preliminary waste characterization).
- Subsurface Conditions at Potential Cofferdam Location
 - In-Water Soil Borings – Drill every 100 to 200 feet along cofferdam alignment. Advance borings to at least 40 feet below mudline or to refusal on bedrock. This will require drilling from a barge.
 - Soil/Sediment Samples – Collect disturbed (ASTM D 1586) and relatively undisturbed (ASTM D 1587) samples for geotechnical laboratory testing.
 - Laboratory Testing on selected samples (recommended testing):

- Moisture content – ASTM D 2216
 - Atterberg limits – ASTM D 4318
 - Grain size – ASTM D 1140
 - Bulk density – from Shelby tube cuttings
 - Specific gravity – ASTM D 854
 - Consolidation testing – ASTM D 2435
 - Consolidated-undrained triaxial compression testing – ASTM D 4767.
- Vane Shear Testing (recommended) – At various depths (usually 5-foot intervals) in borehole to measure the in-situ undrained shear strength of cohesive soil layers (e.g., bay mud). Vane shear testing typically provides a good estimate of undrained strength of cohesive soils. Good undrained strength test results are essential for designing a cofferdam in very soft soils/sediments.
 - The geotechnical investigation needs to be performed by an experienced, licensed professional. Ideally, the engineer who will use the data for design should also design the subsurface investigation program.
- Preliminary Waste Characterization – Composite samples for waste characterization should be collected and prepared to estimate whether the dredged sediment will classify as non-hazardous or hazardous waste. This testing can be combined with bench-scale treatability/solidification testing. The addition of a reagent (e.g., lime) will affect the test results.

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